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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/824,697

04/14/2004

Roger E. Welser

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EXAMINER

RODGERS, COLLEEN E

ART UNIT

PAPER NUMBER

2813

DATE MAILED: 09/30/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

Office Action Summary	Application No.	Applicant(s)	
	10/824,697	WELSER ET AL.	
	Examiner	Art Unit	
	Colleen E. Rodgers	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 April 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>8/13/04 & 4/21/05</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement filed 13 August 2004 contains a duplicated reference: US 6,150,677, issued 21 November 2000, with two different inventors' names (Tanaka et al and Ishizaka et al). Tanaka et al is the correct inventor; the other was not considered.

Specification

2. The disclosure is objected to because of the following informalities: on page 2 of the specification, line 9, the word "electron" should be plural: "Thus, electrons stay in the base longer...." On page 4 of the specification, line 7, the word "layer" should be plural: "one or more transitional layers between the heterojunction." Finally, on the same page, line 8, there is an extra "of"; the sentence is meant to read "... low band gap set back layers, graded band gap layers, doping spikes or a combination thereof."

Appropriate correction is required.

Claim Objections

3. Claim 10 is objected to because of the following informalities: the word "dipolar" should be replaced with --bipolar--. For the purposes of this Office Action, the transistor will be treated as a double heterojunction bipolar transistor.
4. Claim 13 is objected to because of the following informalities: in the first line, "an" should be replaced with --a--.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 13 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, in line three, the phrase "... a surface of a first surface of the base ..." is unclear. Applicant is requested to clarify this language.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

8. Claims 1-4 are rejected under 35 U.S.C. 102(e) as being anticipated by **Chang et al** (USPN 6,765,242 B1).

Regarding claim 1, **Chang et al** discloses a method of fabricating a heterojunction bipolar transistor comprising: growing a base layer comprising gallium, indium, arsenic, and nitrogen [see col. 1, lines 13-18] over an n-doped GaAs collector [see col. 2, lines 17-28] from a gallium, indium, arsenic and nitrogen source, wherein the base layer is p-doped with carbon from an external carbon

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source [see col. 9, lines 46-49]; and growing an n-doped emitter layer over the base layer [see col. 2, lines 13-17].

Regarding claim 2, **Chang et al** discloses that the external carbon source is CCl_4 [see col. 9, lines 46-49].

Regarding claim 3, **Chang et al** discloses that the gallium source is trimethylgallium (TMGa) [see col. 8, line 23].

Regarding claim 4, **Chang et al** discloses that the nitrogen source is dimethylhydrazine (DMHy) [see col. 8, line 24].

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

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11. Claims 5-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Chang et al** (USPN 6,765,242 B1) in view of **Specht et al** (US Patent Application Publication 2005/0020033 A1).

Regarding claim 5, the prior art of **Chang et al** discloses the method of claim 4 as described above. **Chang et al** does not disclose that the ratio of the arsenic source to the gallium source is about 2.0 to about 3.5. **Specht et al** discloses an As/Ga ratio “greater than about 1.0” [see paragraph 0039]. These claims are *prima facie* obvious without a showing that the claimed ranges achieve unexpected results relative to the prior art ranges. See *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art in general conditions is obvious).

Regarding claims 6 and 7, **Chang et al** further discloses that the base is grown “generally in the range of 500 to 650°C” [see Table 1, also col. 9, lines 21-23]. This reads on both claim 6, wherein the base is grown at a temperature of less than 750°C, and claim 7, wherein the base is grown at a temperature of about 500°C to about 600°C.

Regarding claims 8 and 9, **Chang et al** further discloses that the base layer comprises a layer of the formula $\text{Ga}_{1-x}\text{In}_x\text{As}_{1-y}\text{N}_y$, where x and y are preferably $x \geq 0.03$ and $y \geq 0.01$, and further where the values of x and y are related by $x = 3y$ [see col. 8, lines 56-65]. This reads on both claim 8, wherein the base layer comprises a layer of the formula $\text{Ga}_{1-x}\text{In}_x\text{As}_{1-y}\text{N}_y$, wherein x and y are each, independently, about 1.0×10^{-4} to about 2.0×10^{-1} , and claim 9, wherein x is about equal 3y.

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Regarding claim 10, **Chang et al** further discloses that the collector is GaAs [see col. 2, lines 26-28], the emitter is InGaP or AlGaAs [see col. 2, lines 23-26] and the transistor is a double heterojunction bipolar transistor [see col. 1, lines 13-18].

Regarding claims 11 and 12, **Chang et al** further discloses the step of growing an n-doped first transitional layer over the collector and disposed between the base and the collector, wherein the first transitional layer has a graded band gap or a band gap that is smaller than the band gap of the collector. Further, the first transitional layer comprises InGaAs or InGaAsN [see col. 2, lines 41-63].

Regarding claim 13, **Chang et al** further discloses the step of growing a second transitional layer over the base, wherein the second transitional layer has a first surface contiguous with a surface of a first surface of the base and a second surface contiguous with a surface of the emitter, and wherein the second transitional layer has a doping concentration at least one order of magnitude less than the doping concentration of the emitter [see paragraph bridging columns 2 and 3, wherein the doping concentration of the second transitional layer is given as $5 \times 10^{12} \text{ cm}^{-2}$ and Table 1, wherein the doping concentration of the emitter is given as $7 \times 10^{17} \text{ cm}^{-3}$].

Regarding claim 14, the second transitional layer is GaAs [see col. 3, lines 2-8; where $x = 0$, $\text{Al}_x\text{Ga}_{1-x}\text{As}$ becomes GaAs]. It would have been obvious to one skilled in the art at the time of invention to use a constant or step GaAs transition in place of the graded (Al)GaAs transition. One would have been motivated to do so because binary compounds are more stable than tertiary compounds and also in order to simplify manufacturing while still getting some benefit of transition effect.

Regarding claim 15, **Chang et al** further discloses that the first transitional layer, the second transitional layer, or both the first and the second transitional layer have a doping spike, or are δ -doped [see col. 2, line 41 through col. 3, line 8].

Regarding claim 16, **Chang et al** further discloses the step of growing a lattice-matched layer over the collector (or GaAs substrate), wherein the lattice-matched layer has a first surface contiguous with a first surface of the collector and a second surface contiguous with a second surface of the first transitional layer [see col. 1, lines 64-67; see also Table 1, and col. 8, lines 44-49].

Regarding claim 17, **Chang et al** does not disclose a lattice-matched layer of InGaP. It would have been obvious to one skilled in the art at the time of invention to further include a InGaP lattice-matched layer so that the emitter-base junction would be symmetric to the base-collector junction, thereby enabling the structure to be selectively used as either a top emitter or as a bottom emitter device, which is a well known desire in the industry.

Conclusion


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Colleen E. Rodgers whose telephone number is (571) 272-0237. The examiner can normally be reached on Monday through Friday, 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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GEORGE ECKERT
PRIMARY EXAMINER